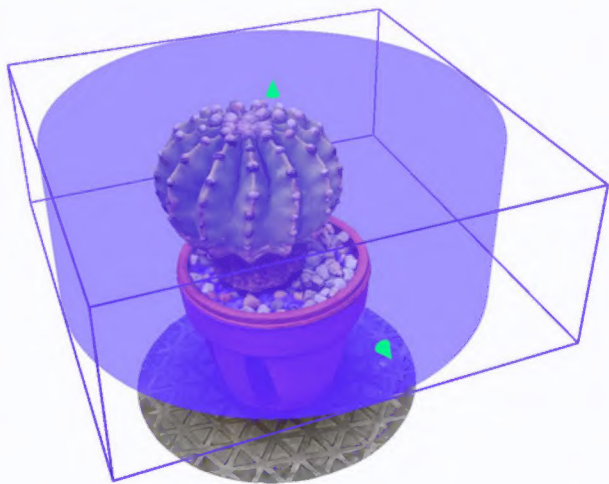


Biomimicry Design





In this collaboration between the **Design Center** and **The Arthur Ross Greenhouse**, we introduce concepts and examples of **biomimicry design**.

Nick Gershberg of Barnard's Greenhouse talks through identifying plant properties to inspire biomimicry design ideation.

We then learn how to apply these biomimetic design principles to our own projects with tools and prototyping processes at the Design Center with Coordinator **Rebecca Naegele**.

What is Biomimicry Design?

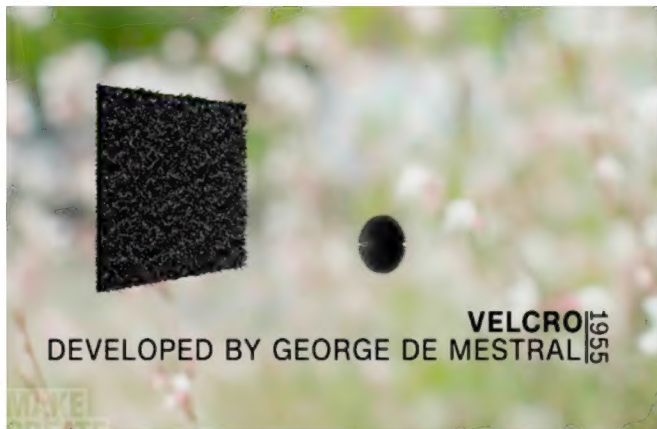


Biomimicry Design is an approach to innovation that looks to nature for inspiration in solving human problems and challenges.

It involves observing and studying how plants, animals, and other organisms have evolved to survive and thrive in their natural environments, and then using those insights to inform the design of human technologies, systems, and processes.

The goal of biomimicry design is to create sustainable and efficient solutions in harmony with nature, rather than working against it.

Biomimicry Examples



By emulating the patterns and strategies found in nature, biomimicry designers aim to create products and systems that are not only more effective and efficient, but also more resilient and adaptable to changing conditions.

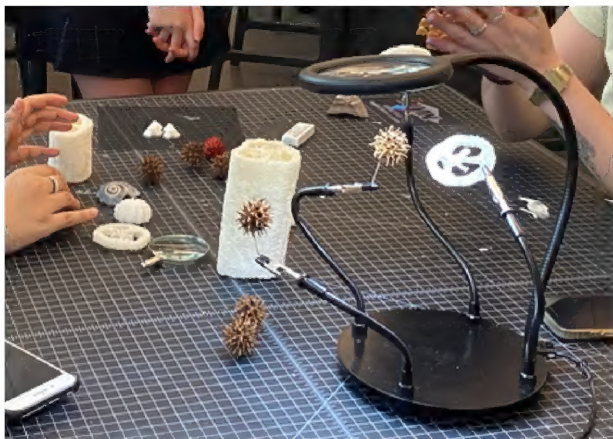
Watch: Biomimicry

video.alexanderstreet.com/watch/bio-mimicry

Columbia University Libraries

0:45 – 2:28min

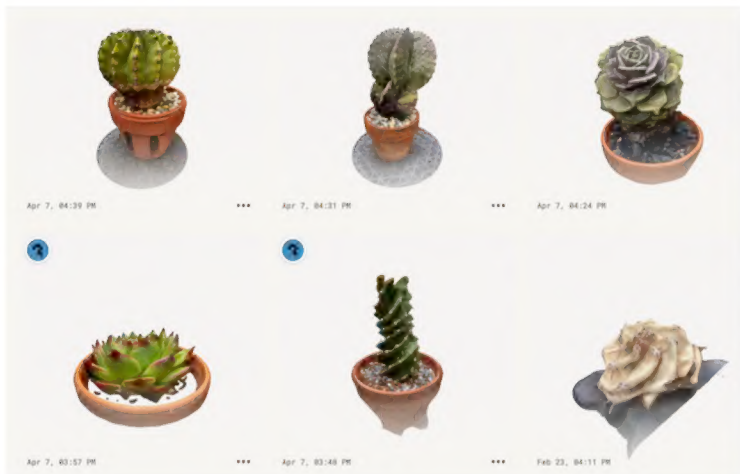
Observation & Analysis



Look at the natural samples in front of you. We have loofahs, sweetgum seed pods, and coral. What forms, textures, structures make up these once-living objects?

Examine with the help of touch, close observation, magnification, illumination, and sketching what you see, noting textures, repetition of form, growth pattern, etc.

3D Scanning with Polycam



We have a well-lit setup at the greenhouse conducive to 3D scanning. Stark shadows will confuse the scanning app – diffuse light is best. Avoid complicated backgrounds.


We'll also have turntables to help with scanning plants to reference and model from later.

Polycam uses Photogrammetry




Photogrammetry is the science of obtaining measurements and 3D data from photographs. It involves taking multiple photographs of an object or scene from different angles and then using software to extract measurements and create a 3D model of the object or scene.


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 **t-rex skull**
6e

Provo, UT
Aug 4, 2PM

The Problem is the Solution

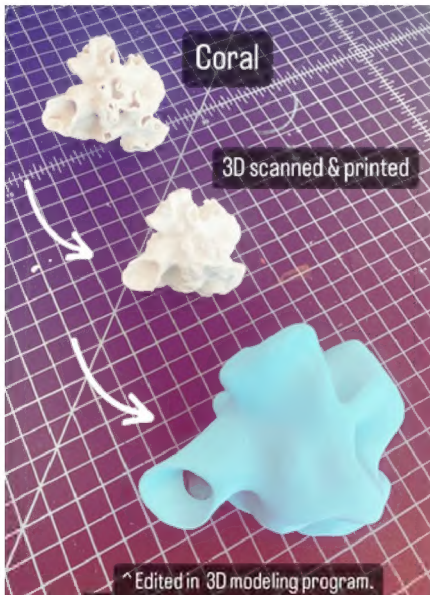


One of permaculture's important concepts, ***the problem is the solution*** means that any perceived problem is an opportunity to generate a solution.

Ex: the problem of the burred seed pod sticking to the pet fur/clothing (actually an intentional seed dispersal method) produces the opportunity to see this function as a solution: creating a temporary attachment system (velcro) inspired by the hook design of these biological forms.

Prototyping Process

Identify a natural form you'd like to work with and 3D scan it to begin. Here, a coral specimen is inspiration for human housing based on this marine life housing structure. Staff member Aishah Bostani created this biomimicry-influenced architectural prototype.



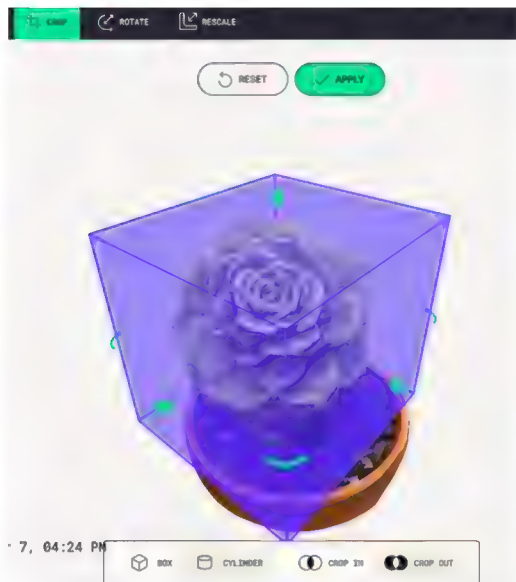
The 3D scan file is imported into a modeling program (Fusion360, Rhino) to modify and edit it, simplifying the form into a smooth and hollowed architectural model prototype.

Spiral shaped cactus inspires water collection structure prototype



This spiral shaped cactus from Barnard Greenhouse is 3D scanned using Polycam app. The spiral form is simplified in a 3D modeling program, edited and 3D printed to create a water collection prototype. This prototype was made by Design Center Graduate Assistant Aishah Bostani.

Editing your 3D scan in Polycam



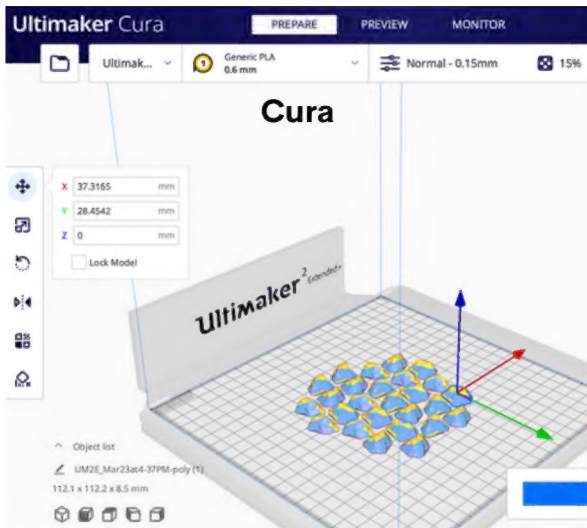
Cropping is fairly intuitive - you'll see rectangular and cylindrical cropping tools to edit out any unwanted background information from the object you're trying to 3D scan. You can rotate your scanned object 360 degrees in the web platform or directly in the app.

Downloading your 3D model file and uploading to Cura for 3D printing



Download your 3D scan in the free version of **Polycam** as a GLTF file. Send the file to a nearby computer to open in Cura to 3D print this scan directly. Cura will slice your 3D model file to additive layers to 3D print directly.

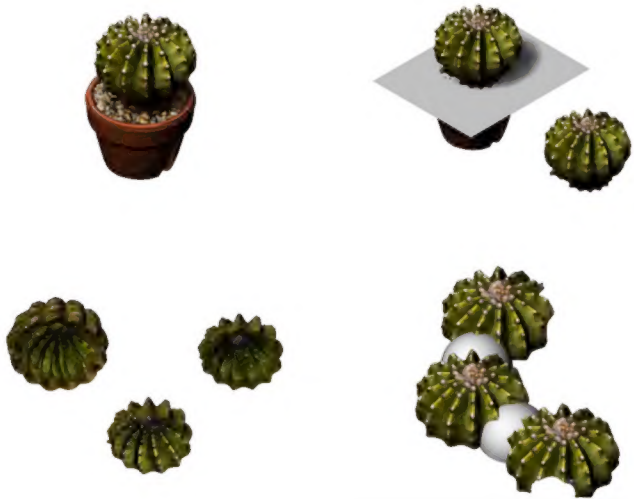
Cura is a free program you can download on your computer to prepare files for 3D printing. Cura is available on all the Design Center's computers and laptops.



Cura can perform basic tasks to prepare your 3D model for printing including scaling, multiplying forms, rotating, and placement on the 3D print bed. Objects are printed by an additive process of subsequent layers of melted filament.

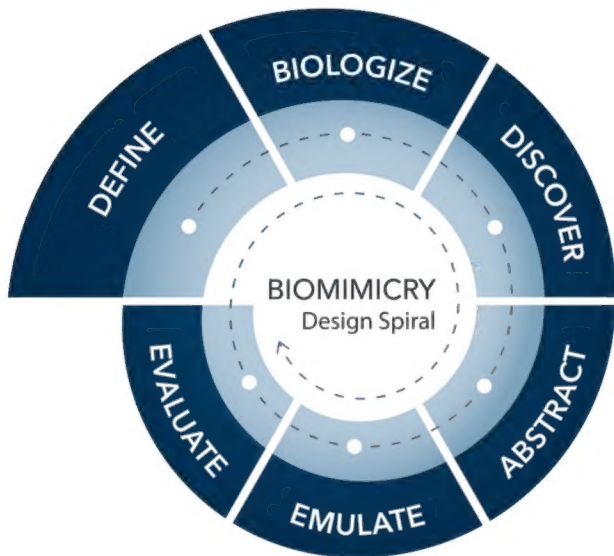
The program will "slice" your model into additive layers that our 3D printers can read, projecting print duration. We have 3D print filaments made of PLA, algae, flexible TPU, dissolvable PVA, etc.

3D Modeling with Rhino



This 3D scanned cactus form from Barnard's Greenhouse inspired Aishah's domicile model to leverage rainwater catch and harvesting in dry environments. 3D modeling can facilitate translating/transforming biological forms to a legible architectural model or prototype with a form and function drawn from nature.

Further Resources



The Biomimicry Toolbox toolbox.biomimicry.org

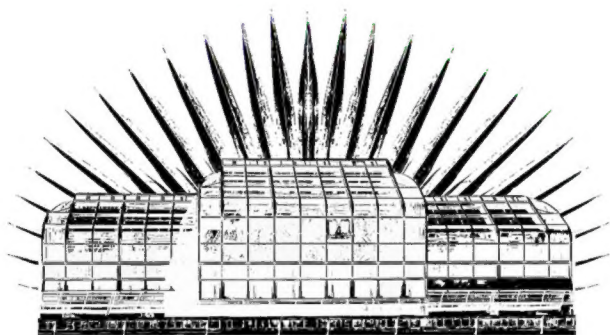
The Biomimicry Institute biomimicry.org

Biomimicry 3.8 biomimicry.net

Learn Biomimicry learnbiomimicry.com

Biomimicry derives from *bios*,
meaning life, and *mimesis*, to imitate

Spring 2023



THE ARTHUR ROSS GREENHOUSE
AT BARNARD COLLEGE



Design Center

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